Independent Verification & Validation Facility	**Work Instruction for IV&V Services Risk Management**	**IVV 09-4-1** **Revision: A** **Effective Date: August 22, 2005**

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APPROVAL SIGNATURES		DATE
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REVISION HISTORY			
Rev. No.	Description of Change	Author	Effective Date
Basic	Initial Release	D. Solomon, M. Fisher, K. Vorndran	10/31/2004
A	Update for new organizational structure by changing Senior Lead to Deputy IV&V Services Lead	Steve Raque	08/22/2005

REFERENCE DOCUMENTS	
Document Number	Document Title
IVV 05	Document and Data Control
IVV 09-4	Project Management
IVV 16	Control of Quality Records
NPR 1441.1	NASA Records Retention Schedules
NPR 1442.1	NASA Uniform Files Index
NPR 7120.5	Program and Project Management Processes and Requirements
NPR 8000.4	Risk Management Procedures and Guidelines

1.0 Purpose

The purpose of this work instruction (WI) is to establish a consistent method for performing risk management throughout the life cycle of an IV&V Project.

2.0 Scope

This WI is applicable to all projects within the IV&V Services area. With the exception of how to handle a risk that turns into an issue, this WI is not intended to address the handling and/or tracking of project-related issues.

3.0 Definitions and Acronyms

3.1 Development Project

A Development Project is a systems/software development effort that typically delivers space, ground, and aeronautical systems, technologies, services, and operational capabilities to NASA customers.

3.2 Development Project-Related Risk

A Development Project-Related Risk is the identification of a potential undesirable event that may hinder the development organization from meeting its goal or mission (e.g., an inadequate test program resulted in a risk of unidentified errors during operation).

3.3 Issue

An issue represents an undesired event and/or situation that currently exists. A risk may turn into an issue and an issue may spawn a risk.

3.4 IV&V Project

An IV&V Project is a set of IV&V activities performed for a customer. See IVV 09-4, Project Management, for details.

3.5 IV&V Project Manager

An IV&V Project Manager is a NASA IV&V Facility civil service employee appointed by Facility Management to perform project management functions.

3.6 IV&V Project-Related Risk

An IV&V Project-Related Risk is a risk to the performance of IV&V (unable to perform IV&V to the technical level necessary within the schedule and funds allocated [e.g. Project is issuing immature artifacts which are requiring significantly more effort to analyze]) or risk(s) to the NASA IV&V Facility (risks that may impact the NASA IV&V Facility as a whole [e.g. potential project cancellations, low quality product delivered to the customer]).

3.7 Project Issue Tracking System (PITS)

PITS is a NASA IV&V Facility-governed tool for managing issues related to an IV&V Project.

3.8 PITS Risk Management System (RMS)

PITS RMS is a NASA IV&V Facility-governed tool for managing Development Project-Related Risks on an IV&V Project.

3.9 Project Management Review (PMR)

A PMR is a monthly status review/presentation of an IV&V Project to Facility Management.

3.10 Project Management Tool (PM Tool)

The PM Tool is a NASA IV&V Facility-governed tool to facilitate the management of an IV&V Project, including managing IV&V Project-Related Risks.

3.11 Risk

A risk is the combination of 1) the probability (qualitative or quantitative) that a program or project will experience an undesired event such as cost overrun, schedule slip, safety mishap, compromise of security, or failure to achieve a needed technological breakthrough; and 2) the consequences, impact, or severity of the undesired event were it to occur (NASA Procedural Requirement [NPR] 7120.5).

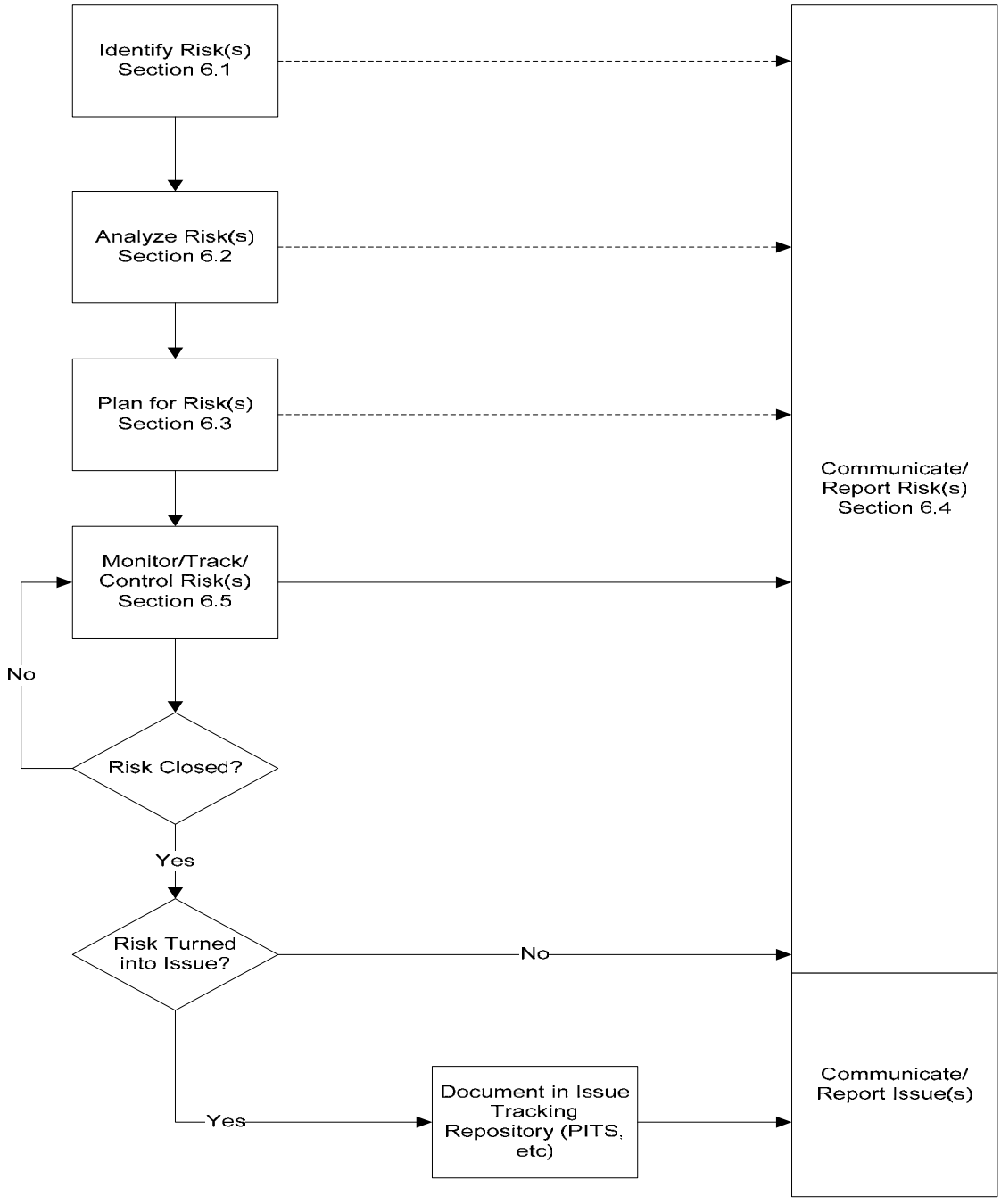
3.12 Trend

A trend is a characteristic associated with a risk that describes current state of a risk. A trend may be “new since last reporting period”, “decreasing”, “increasing”, or “unchanged”.

3.13 Acronyms

GPMC	Governing Program Management Council
MSR	Monthly Status Report
MSSR	Monthly Software Status Report
NPR	NASA Procedural Requirement
PITS	Project Issue Tracking System
PMR	Project Monthly Review
RMS	Risk Management System
SAS	Supplier Assessment System
WI	Work Instruction

4.0 Flow Chart



5.0 Responsibilities

5.1 Deputy IV&V Services Lead

The Deputy IV&V Services Lead shall provide recommendations to the IV&V Project Manager on communicating and reporting risks pertaining to elevating risks to various forums and/or reviews.

5.2 IV&V Project Manager

The IV&V Project Manager is responsible for planning, identifying, analyzing, monitoring, tracking, controlling, communicating, and reporting the risks on his or her IV&V Project.

6.0 Procedure

The IV&V Project Manager shall document the risk management approach for his or her IV&V Project in the associated IV&V Project Plan. Risks that are typically encountered during an IV&V Project can be categorized into Development Project-Related Risks and IV&V Project-Related Risks. The following subsections describe the activities associated with identifying, analyzing, planning, monitoring, tracking, controlling, communicating, and reporting these risks.

6.1 Identify Risk(s)

As part of his or her project management activities, the IV&V Project Manager shall identify risks associated with his or her IV&V project throughout the IV&V Project's life cycle, including the project initiation activities.

The IV&V Project Manager or designee shall generate a statement for each identified risk that illustrates the consequence of a present or future event. The appropriate format for a risk statement is:

If *X*, Then *Y*. (where *X* is the event, and *Y* is the consequence)

Additional guidance on writing risk statements can be found in NPR 8000.4, Risk Management Procedures and Guidelines. In addition, information pertaining to NASA's overall continuous risk management process/philosophy can be found at http://www.crm.nasa.gov/.

Note: The IV&V Project Manager may utilize and leverage numerous sources when identifying risks including, but not limited to, lessons learned, historical data, previous analysis, IV&V team members, Supplier Assessment System (SAS) database, system safety and reliability analysis, startup assessment, and survey data.

6.2 Analyze Risk(s)

For each identified IV&V Project Related Risk, the IV&V Project Manager shall analyze the risk to determine the likelihood of occurrence, consequences of the risk, and the "need by date" which indicates the timeframe by which action must be taken to prevent the undesirable situation from occurring. Tables 6-1, Criteria for Determining Likelihood of Occurrence, and 6-2, Criteria for Determining Consequences, provide the IV&V Project Manager with criteria to ascertain the likelihood of occurrence and the consequences of risks. For each identified Development Project-Related Risk, the IV&V Project Manager shall determine the likelihood of occurrence and consequences of the risk using the Development Project's criteria definitions for likelihood and consequence.

Likelihood: What is the probability that the situation or circumstance will happen?	
5 (Very High)	Very likely to occur. Project's process cannot prevent this event, no alternate approaches or processes are available. Requires immediate management attention.
4 (High)	Highly likely to occur. Project's process cannot prevent this event, but a different approach or process might. Requires management's attention.
3 (Moderate)	Likely to occur. Project's process may prevent this event, but additional actions will be required.
2 (Low)	Not Likely to occur. Project's process is usually sufficient to prevent this type of event.
1 (Very Low)	Very unlikely. Project's process is sufficient to prevent this event.

Table 6-1 - Criteria for Determining Likelihood of Occurrence

	1 (Very Low)	**2** (Low)	**3** (Moderate)	**4** (High)	**5** (Very High)
Technical	Minimal or no impact to mission or technical success/exit criteria or margins. Same approach retained.	Minor impact to mission or technical success/exit criteria, but can handle within established margins. Same approach retained.	Moderate impact to mission or technical success/exit criteria, but can handle within established margins. Workarounds available.	Major impact to mission or technical success criteria, but still meet minimum mission success/exit criteria, threatens established margins. Workarounds available.	Major impact to mission or technical success criteria, cannot meet minimum mission or technical success/exit criteria. No alternatives exist.
Schedule	Minimal or no schedule impact, but can handle within schedule reserve; no impact to	Minor schedule impact, but can handle within schedule reserve; no impact to critical path.	Impact to critical path, but can handle within schedule reserve, no impact to milestones.	Significant impact to critical path, and cannot meet established lower level milestone.	Major impact to critical path and cannot meet major milestone.
Cost	Minimal or no cost impact or increase over that allocated, and can be handled within available reserves.	Minor cost impact, but can be handled within available reserves.	Causes cost impact and use of allocated reserves.	Causes cost impact, may exceed allocated reserves, and may require resources from another source.	Causes major cost impact and require additional budget resources from another source.

Table 6-2 – Criteria for Determining Consequences

6.3 Plan for Risk(s)

For IV&V Project-Related Risks only, the IV&V Project Manager shall plan the actions to be taken for each identified risk. Actions that may be taken include:

a. Mitigate: includes applying methods aimed at eliminating the risk or reducing the likelihood and/or consequence of a risk. This may be

accomplished through engineering, schedule or budgetary changes, or alternate paths and approaches.

b. Accept: includes understanding the risk to sufficient detail and obtaining agreement by Facility Management that no action is required.

c. Research: includes the collection of additional information, evaluation and reporting of results on which to base future decisions, or, at times, reduction of the uncertainty surrounding risk estimates.

d. Watch: includes deciding not to take immediate action, but to track, survey, or watch the trends and behavior of risk indicators over time.

For Development Project-Related Risks, the IV&V Project Manager may identify and suggest to the Development Project an appropriate action to be taken for each identified risk.

6.4 Communicate and Report Risk(s)

Communication of and reporting on identified risks occurs at various levels, forums, and frequencies using various tools and repositories. The IV&V Project Manager shall ensure that the identified risks and associated metadata contained in these repositories is maintained throughout the life cycle of the risk.

The activities described in the following subsections include nominal communication and reporting requirements, and resources for applicable risk categories. However, it should be noted that the IV&V Project Manager may desire to elevate the visibility and attention of a certain risk, and may choose to utilize the Monthly Status Reviews (MSRs) at the Governing Program Management Council (GPMC) level and/or other reviews to communicate and report risks. Prior to using these forums to communicate and report on a risk, the IV&V Project Manager should consult with the Deputy IV&V Services Lead.

6.4.1 IV&V Project-Related Risk(s)

The IV&V Project Manager shall initially document the IV&V Project-Related Risk in the PM Tool. For each risk, the following information is identified:

- Risk ID
- Date Opened
- State (Open/Closed)
- Risk Title
- Risk Statement
- Likelihood and Consequence rating
- Rationale
- Need By Date
- Trend (Increasing, Decreasing, Unchanged or New)
- Approach (Mitigate, Accept, Research, Monitor)
- Plan
- Risk Status

Subsequently, the IV&V Project Manager shall present the IV&V Project-Related Risks for his or her IV&V project, at the Project Monthly Review (PMR) using the PMR template. The template prescribes the reporting format for risks and includes a 5X5 risk matrix, a summation of all IV&V Project-Related Risks, and detailed information for these risks. An example of the 5X5 risk matrix is provided in Figure 1, NASA IV&V Facility 5x5 Risk Matrix.

6.4.2 Development Project Related Risk(s)

The IV&V Project Manager or designee shall document the risk in Project Issue Tracking System (PITS) Risk Management System (RMS). In addition, the IV&V Project Manager may communicate and report on these risks in the “Significant Accomplishments” area of the PMR as appropriate. Typical items to be reported on each risk include a brief description of the risk and what action(s), if any, the Development Project has taken as a result of the risk. This may include a statement that the risk was rejected or accepted into the Development Project’s RMS, mitigation actions initiated, and so on.

In addition, the IV&V Project Manager shall communicate and report the risk to Development Project personnel in the Monthly Software Status Report (MSSR). If applicable, the IV&V Project Manager may submit and/or document the risk into the Development Project's Risk Management System as well.

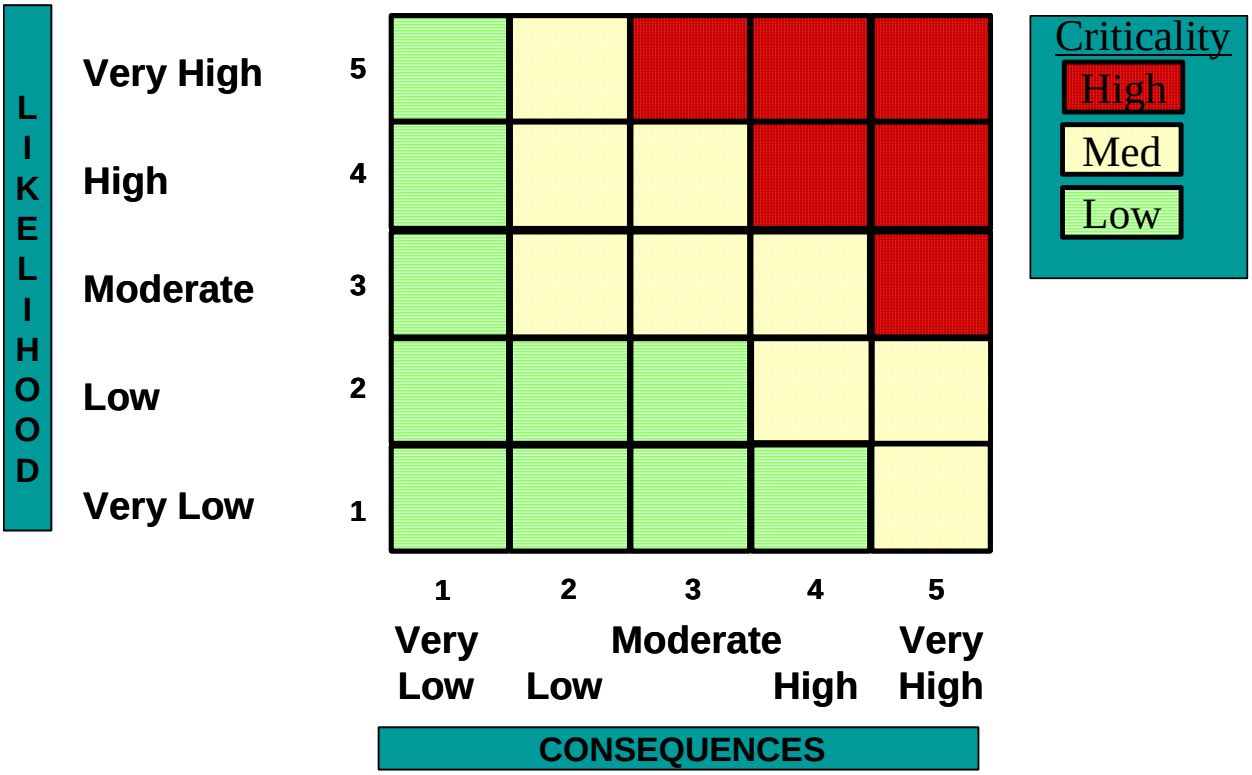


Figure 1 – NASA IV&V Facility 5x5 Risk Matrix

6.5 Risk Monitoring, Tracking, and Control

Throughout the IV&V Project life cycle, the IV&V Project Manager shall monitor and track the status of all identified risks, as well as the associated actions for the risks. Tracking shall be performed at a level to ascertain whether the risk is decreasing, increasing, or remaining the same over time, and whether the associated action(s) are being performed in a timely fashion.

The IV&V Project Manager shall continually reevaluate identified risks based upon the risk tracking data generated/collected, and initiate necessary actions as required. For IV&V Project-Related Risks, actions that could be taken include, but are not limited to, adjusting the current action plan, closing the risk, invoking a contingency plan when the original plan was found to be ineffective, or continuing with the original plan and actions associated with the risk.

If the risk has come to realization and becomes an issue based upon the risk tracking data, the IV&V Project Manager may choose to close the risk and open an issue in PITS and invoke the appropriate issue resolution activities.

Throughout the life cycle of the risk(s), the IV&V Project Manager shall update any metadata associated with these risks contained within the PM Tool, PITS RMS, and/or the Project's Risk Management System (if applicable).

7.0 Metrics

Metrics associated with this WI are established and tracked within the NASA IV&V Facility's Metrics Program.

8.0 Records

The following records are generated and filed in accordance with this WI and IVV 16, Control of Quality Records, and in reference to NPR 1441.1, NASA Records Retention Schedules.

Document Name and Identification Number	User Responsible for Record Retention	Retention Requirement	Location
PMR	IV&V Project Manager	Permanent – Retire to FRC when file is closed	Shared Network Drive
Risk Entry	IV&V Project Manager	Permanent	PM Tool